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SYNOPSIS AND REVIEW OF THE SPECIES OF COELUS (COLEOPTERA; TENEBRIONIDAE)

BY FRANK E. BLAISDELL, SR.

For many years but two species of *Coelus* were recognized, *ciliatus* Eschscholtz and *globosus* Leconte, both inhabitants of the sandy maritime districts along the Pacific Coast. In 1890, Col. Thos. L. Casey reviewed the genus and described two new species, *grossus* and *arenarius*. In 1895, the same author again reviewed this genus defining two additional species, *latus* and *curtulus*, while in his more recent revision of the Coniontini the number of species has been increased to fifteen with one subspecies.

The present reviewer began the accumulation of material in this genus in 1890, while living at Coronado, San Diego County, California. Immediately after the appearance of Col. Casey's first and short revision, *Coelus grossus* was obtained from Mr. G. W. Dunn, who collected it at Santa Barbara, California. The present paper is the outcome of repeated examination of hundreds of specimens from different parts of the Pacific Coast from San Diego to the shores of Humboldt Bay. Notes made some twenty-nine years ago will be used here for the first time.

Before proceeding further the author takes pleasure in acknowledging his indebtedness to the following friends, who have loaned him their material in this genus or have collected series for him on request: Prof. H. C. Fall, Dr. Fenyès, J. O. Martin, Ralph Hopping, Dr. E. C. Van Dyke, L. S. Slevin, L. R. Reynolds, H. W. Nunenmacher, G. R. Pilate, and the California Academy of Sciences through its Curator of Entomology, E. P. Van Duzee.

Long series have been collected in the vicinity of San Diego and San Francisco; smaller lots at Dipsea and Tomales Bay, Marin County, and at Samoa, Humboldt Bay, all from California. In all many hundreds of specimens have been systematically examined to test the intra-specific characters and to determine how they vary and whether they correspond to published values. Much time has been devoted to the comparison and arrangement

of the material according to the variation of morphological peculiarities, in order to find definite characters by which to define the different forms to be recognized as taxonomic grades, and to avoid the use of unnecessary and impractical qualifying terms.

As a result of this study the following characters have been found of definite value: Punctuation of labrum, degree of epistomal sinuation, degree of transverse impression of the front and degree of abruptness with which the base of the epistoma arises from the frontal suture, punctuation of the pronotum, shape and sculpturing of the mentum and degree and character of the sculpturing of the prosternum, especially that on the process. The following facts also were determined:

Color is without taxonomic value. Paleness means immaturity or retarded or inhibited pigmentation and is purely physiological and environmental. Large series of *Coelus globosus* taken in February from sand dunes at Ocean Beach, San Diego County, were entirely testaceous to castaneous; later in the season specimens from the same dunes were rufo-piceous or nigro-piceous, at other times black without exception. Occasional pale specimens taken among others entirely dark simply implies sporadic development after the main broods have appeared.

Form is equally without taxonomic value. In large series of nearly all grades, when not founded on form alone, variations in body form are abundant. The shape varies from oblong-oval, more or less broad, to somewhat elongate oblong-oval, or elliptical. This fact can readily be appreciated if the individuals of a species or race are arranged in a block system. Such an arrangement will show that males of *Coelus ciliatus*, for instance, may be elongate-oval or broader and oblong with all degrees of transition between the extremes, other characters being identical in the series.

Unusual development in size is of some value, as in *Coelus grossus* and its form *saginitus*, and smallness, in part at least, as in *Coelus debilis*.

Elytral inflation is a characteristic of *Coelus globosus* and its races. As a rule the males in each species are considerably less convex than are the females.

Shape and degree of constriction of the prosternal process is of no value. This process is rather more constricted between the coxae in *Coelus ciliatus* than in *Coelus globosus* but variable in form in the same species or race.

Pronotal punctuation is of value, but the large impunctate areas are not fixed and vary beyond all usefulness and simply indicate degree of variation. For instance in certain specimens of *Coelus grossus* they are large and unmistakable, but in a series these areas become evanescent and pass into the regularity of punctuation observed in *saginitus*. Frequently large impunctate areas will disappear entirely after immersion in chloroform; a part of the technique in the preparation of specimens for study has been a routine bath in chloroform.

Casey has given the general characteristics of the genus as follows: "Body oval to oblong-oval, always strongly convex in form, with a dense fringe of erect fulvous setæ along the sides and with bristling hairs of the same nature on the legs, along the anterior margin of the pronotum and on the head behind the suture, but otherwise subglabrous."

The head is sinuate anteriorly with a deeply impressed transverse suture, which becomes a valuable aid in the division of the forms into groups, when taken in relation to the epistoma and frons. The sides of the epistoma project laterally far beyond the eyes, which are basal and more or less concealed by the pronotum.

The pronotum is transverse, narrowed to apex which is deeply sinuate, its base truncate with a fine coriaceous margin and the hind angles are not at all produced posteriorly. The scutellum is sinuate and triangular, or occasionally obsolete, much depending upon whether the pronotum is flexed or extended.

"The elytra are rounded, feebly embracing the sides of the body beneath. Epipleuræ narrow, gradually wider and more or less concave basally."

Casey also states that the legs are short and stout, all the tibiæ subequally dilated externally at tip, the terminal spurs long and hollowed or flattened on their under surface. The tarsi are very slender, moderately long, with the joints swollen distally and bearing each a terminal corona of stiff fulvous setæ; the hind coxæ narrowly separated as in *Coniontis*.

The original species of Eschscholtz and LeConte are not only very distinct but they are centers about which a number of geographical races and forms may be assembled. These two groups may be defined as follows:

Epistoma arising gradually from the frontal suture; sides of the mentum more or less arcuate. **Globosus** Group

Epistoma arising abruptly from the frontal suture; sides of the mentum straight, sometimes subangulate at middle and strongly divergent.

Ciliatus Group

The above characters vary within certain limits and if one of them is not as evident as might be the other will be, and acts as a control in determining the group. They do not intergrade. In the *Ciliatus* Group the front of the head has a punctate triangularly flattened area, with its apex at the vertex and its base at the frontal suture, the sides extending from vertex to front of the eyes. In the *Globosus* Group the front is more or less feebly convex and the transverse impression is much more shallow.

GLOBOSUS GROUP

Synopsis of the Globosus Group

Epistoma very deeply sinuate. Mainland species.

Size medium; pronotal surface deeply and closely punctate throughout. **globosus** Leconte

Size large.

Form more or less oblong-oval to oblong-elliptical; pronotal surface with large impunctate areas, otherwise sparsely and more or less finely and deeply punctate. **globosus** var. **grossus** Casey

Form broader and oblong-oval in both sexes; pronotal punctures coarse, rather closely and quite evenly placed.

globosus var. **grossus** form **saginitus** Casey

Epistoma broadly and very feebly sinuate, the sinus generally subevenly rounded. Insular species.

Elytra as densely but more finely punctate than the pronotum, feebly asperate on the declivity; pronotum moderately densely, evenly punctate throughout. Islands of San Nicolas to San Miguel. **pacificus** Fall

Elytra finely, densely punctate without trace of asperity; pronotum subopaque, densely and coarsely punctate. Island of San Clemente.

remotus Fall

Coelus globosus Leconte

A series of eighty-one specimens taken from a single sand dune at Ocean Beach in February, 1891, shows this species to be absolutely distinct from *ciliatus* Esch. In these and others taken at

Coronado, San Diego County, California, in April of the same year, the color varies from testaceous of immaturity to dark nigropiceous of maturity. They occur abundantly.

Form subquadrate oval and strongly convex.

Labrum very sparsely punctate; punctures small.

Epistoma coarsely and rather evenly punctate, the punctures not crowded, scarcely coalescent, although laterally on the lobes they become more closely placed and the surface is distinctly impressed; lobes prominent anteriorly, quite evenly and semicircularly rounded from the sinus to the oblique suture, the latter attaining the margin which is sinuate at that point.

Front oblique and on almost the same plane as the epistoma; frontal suture rather deeply and narrowly impressed, the epistoma arising more or less gradually from it.

Mentum large, sides arcuate, often somewhat sinuate behind the apices; margin usually heavily beaded, apex more or less deeply and broadly sinuate, sinus arcuate; surface more or less impunctate centrally toward the apex and rather strongly convex; medially toward the base coarsely punctate and usually quite strongly impressed along the lateral margin.

Pronotum moderately transversely convex; sides broadly arcuate, more strongly so toward the base; apical angles not deflexed; surface coarsely, deeply and closely punctate throughout, the punctures scarcely differing toward the explanate sides where they are subequal to those on the disk.

Prosternum coarsely and quite densely rugoso-punctate before the coxae and process; the latter shining, coarsely punctate throughout and more or less distinctly margined between the coxae.

Male: In this sex the elytra are not strongly inflated and the form is rather more broadly oval with the pronotum more explanate and variable as regards width.

Female: Rather more oblong with the elytra more or less strongly inflated posteriorly.

Measurements.—Length, 7–7.5 mm.; width, 4–5.5 mm.

The only characters to be relied upon for recognition of typical *globosus* are size and character of pronotal punctuation. The extremes graduate into those of the variety *grossus* and the latter into its form *saginitus*.

***Coelus globosus* var. *grossus* Casey**

Specimens of this variety are at hand that were collected at Santa Barbara, Santa Monica, Redondo, San Diego and Santa Cruz, the latter in June. It is the largest form in the genus.

Size large. Form oblong-oval to oblong-elliptical.

Labrum sparsely and distinctly punctate, its surface otherwise glabrous.

Epistoma arising very gradually and arcuately from the rather deeply impressed suture; surface coarsely punctate; punctures usually well separated,

those on the middle anteriorly somewhat smaller; sinus deep, lobes very prominent, semicircularly rounded, the surface rather deeply impressed next to the sinus; sides arcuato-sinuate, oblique suture more or less distinct; punctures of the front immediately behind the suture coarse, close, coalescing to a varying degree and almost without hairs at the middle. Frontal plane commencing at the suture and very feebly convex.

Pronotum rather sparsely and more or less finely and deeply punctate, these punctures uneven in distribution with large impunctate areas, becoming closer and mingled with larger punctures on the expanded lateral margin; sides broadly arcuate, converging anteriorly; apical angles more or less broadly rounded.

Mentum large; apex deeply and broadly sinuated; sides more or less arcuate, lobes rather broadly rounded; surface with a few coarse punctures in the central area but otherwise smooth, deeply impressed and rough along the sides and base.

Prosternum coarsely punctato-rugose before the coxae; process coarsely punctate throughout and rather broadly margined between the coxae.

Elytral sculpturing rather strongly muricate.

Male.—Somewhat broader and rather less inflated.

Female.—More oblong and more or less strongly inflated.

Measurements.—Length, 8.5–12 mm.; width, 5–7 mm.

The chief characteristics of *grossus* are the large size, coarse punctuation and the large impunctate areas of the pronotum.

This variety is plainly related to *globosus* by the deep epistomal sinuation, shape and sculpturing of the mentum, form, and punctuation of the prosternal process. In extreme cases not distinguishable from *globosus*.

Coelus globosus var. **grossus** form **saginat** Casey

Size large. Form broad, oblong-oval. Pronotal punctures coarse, rather closely and quite evenly placed.

Apparently there is less difference in shape between the sexes in this form than in *grossus*; the body is rather shorter in *saginat*, although in a large series from the same area this difference becomes evanescent.

Casey gives the following measurements: Length, 7.6–9.6 mm.

A large series collected at San Pedro, March 13th, 1910; Arch Beach, April 4th, 1916, and Redondo, March 5th, 1898, quite convincingly demonstrates that *saginat* is a form of *grossus*. They inhabit the same areas and behave like individuals of a single species.

Coelus pacificus Fall

Form broadly oblong, elliptical and moderately convex; color piceous-black, surface polished.

Labrum with a few small scattered punctures near the apex, surface otherwise smooth.

Epistoma arising very gradually from the frontal suture and rather finely sculptured, broadly sinuate at apex.

Mentum broadly and not deeply sinuate at apex; sides more or less arcuate, coarsely margined; surface rather convex medially at apex, elsewhere more or less impressed and asperato-punctate but rather glabrous along the apical margin.

Pronotum moderately, densely, evenly punctate throughout, widest immediately before the base; sides rather feebly arcuate and strongly convergent.

Prosternum coarsely and somewhat asperately punctate; punctures not crowded. Process very coarsely margined between the coxae; submarginal groove strong; central area convex; dilated apical portion more or less glabrous and, in the examples examined, broadly impressed.

Measurements.—Length, 7 mm.; width, 5 mm.

Seventy-five examples studied. Fall states that the prothorax is equal in width to the elytra; a little more than twice as wide as their length at the middle. These characters have been found to be very variable in the series examined.

“Elytra twice as long as the thorax along the median line, not longer than wide; equally densely but more finely punctate than the pronotum. The marginal fringe of hairs on the prothorax is noticeably shorter and finer than in any of our mainland species.”

Type region, San Nicholas Island. Type collected on May 24th. Fall mentions a series taken by Dr. Eisen on Santa Rosa Island and states that, with the exception of some variation in size, these differ in no noticeable respect from the type. The author has examined material from both of these islands and possesses a specimen collected on Santa Rosa Island, kindly given to him by Prof. Fall. Mr. Van Duzee recently (May 17–20, 1919) visited Santa Cruz and San Miguel Islands where he collected a series of sixty-nine specimens of *pacificus*. These have afforded an opportunity to study the sexual differences and show the males to be usually broader and more oblong than the females.

Coelus remotus Fall

Form very convex; color piceous-black; legs and elytra brown; *epistoma* broadly sinuate; *pronotum* similar in outline to *pacificus* but shorter, its surface subopaque, densely, coarsely punctate; *elytra* polished, densely, finely punctate, without trace of asperities.

Measurements.—Length, 6.5–7 mm.; width, 4–4.5 mm.

Remotus is the only described form not at hand for study and Fall's description has been repeated. Type region, San Clemente Island, collected on June 3rd. The marginal fringe here is longer than in *pacificus* but thinner than usual. Fall's remarks are interesting: "Both the above species (*pacificus* and *remotus*) were found under rubbish at a distance from the shore and have notably the habits of *Coniontis* and *Coelotaxis* rather than of the other members of the genus. This might indeed be safely inferred from the less developed marginal hairs and lack of elytral asperities which have an undoubted connection with the habits possessed by the mainland species of burrowing, or rather, as seems to me more likely, the burrowing habit is of recent development and the island species are the remaining representatives of an earlier type." It might be added here that Mr. Van Duzee took his specimens of *pacificus* from Santa Cruz Island on the flat sand areas immediately above high water mark, while those from San Miguel Island were taken on the ancient sand dunes from high water line up to 300 feet elevation. They were all dug from sand about the roots of plants, as are *ciliatus* and other mainland forms.

It has been observed in the mainland forms which occur inland somewhat beyond the sand dunes, where the land is overgrown with plants of the perennial lupines and *Baccharis pilularis* D. C.,¹ that the elytral sculpturing is much less developed, as in *debilis* Casey. In many specimens of the latter the elytra are scarcely asperate. This was especially noticed and studied in the series taken at Tomales Bay.

Typical *ciliatus* is found right up to the sea beach and offers much variation in elytral sculpture. It looks doubtful whether simple elytral punctures and less developed lateral fimbriae should be considered as characters of subgeneric value. As a matter of fact most of the specimens of *pacificus* studied have the elytra asperately sculptured as do many examples of *ciliatus* and particularly of *debilis* Casey, as mentioned above. There is no good reason for the grade of *Pseudocoelus* unless it be because of its insular habitat. In *ciliatus* the fringe of erect fulvous hairs and those on the legs are particularly well developed, but less so in *globosus* and *arenarius*, including *debilis*. The antennal club is

¹ A dioecious composite shrub on the coast hills that is low and spreading, forming a more or less dense mat under which many species of insects find a hiding place.

not clearly defined in any single form, much less can it be said to be comprised of a definite number of joints, the width of the seventh and eighth varying in a series, leaving this character of no value.

CILIATUS GROUP

Synopsis of the Ciliatus Group

Epistoma more broadly and not deeply though conspicuously sinuate, sinus at bottom more or less transverse; prosternal process more or less glabrous and usually much less or scarcely punctate longitudinally along the middle third and central area of the dilated apex.

Average size moderate.

Pronotal surface rather finely, very sparsely punctate, the punctures larger at base than at apex and unequally distributed, leaving occasional impunctate areas, with scattered coarse punctures at the sides.

ciliatus Eschscholtz

Pronotal surface finely punctate throughout, punctures very sparsely placed.....**ciliatus** var. **sparsus** new variety

Average size small.

Pronotal punctures irregular, fine but dense toward the sides; impunctate areas not evident.....**ciliatus** var. **debilis** Casey

Epistoma broadly and very feebly sinuate, the sinus generally subevenly rounded. Process as in *ciliatus*.

Form variable, oblong-oval, or elliptical, sometimes narrowly elongate-elliptical.

Pronotal punctures strong and not very coarse, more or less irregularly distributed, sometimes leaving impunctate areas.

Prosternum in front of coxae and process not strongly punctate and more or less asperate.....**arenarius** Casey

Prosternum strongly, coarsely punctate, punctures impressed and rounded, scarcely at all confluent..**arenarius** var. **sternalis** Casey

Form stout, oblong to subquadrate. Pronotal punctures quite evenly distributed, coarse and closely placed.

Prosternum coarsely and more or less confluent punctate, subrugose.

arenarius var. **latus** Casey.

Coelus ciliatus Eschscholtz

Large series of specimens have been collected yearly and carefully examined in a relaxed condition, with all parts protruded or drawn out. The characters here recorded have been verified over and over again.

Form oblong-oval, strongly convex. *Labrum* glabrous, usually with two to six punctules along the apical margin. *Epistoma* broadly and not deeply sinuate, punctuation strong, somewhat swollen at about the middle third, there sparsely punctate; base arising abruptly from the frontal suture and

transversely punctato-rugose; surface rather broadly flattened and impressed laterally on the lobes; impression varying in degree, elongate and parallel to the side margin, densely and coarsely punctate; lobes not prominent, subequally rounded; sides more or less oblique, sometimes broadly sinuate opposite the oblique suture. *Front* broadly, rather deeply and transversely impressed, impression rather arcuately excavated, strongly and densely punctate, quite sharply defined from the vertex; each puncture with a conspicuous long yellow hair which may be disorderly directed.

Mentum densely punctato-scabrous and more or less carinate along the median line; apex very broadly and feebly sinuate; sides strongly divergent and nearly straight; lobes quite narrowly rounded.

Pronotum strongly convex transversely, rapidly declivous laterally; sides more or less arcuate; moderately and subevenly converging, frequently more strongly so, from base to apex; disk glabrous, polished, punctures very fine and sparse, unequally distributed with occasional impunctate areas, laterally with many coarse punctures intermixed, bearing yellow hairs; sides narrowly explanate; apical angles rather narrowly rounded.

Prosternum rather coarsely, moderately densely and more or less asperately punctate. Process glabrous, more or less impunctate on the dilated apex and along the median area between the coxae, punctures rather coarse and peripheral in position, bearing long yellow hairs; submarginal groove more or less strong between the coxae.

Measurements.—Length, 5.5–8 mm.; width, 3.2–4.5 mm.

Male: Oblong-oval and less inflated; pronotal sides more strongly arcuate or nearly as in the female; elytra less convex.

Female: Oblong-oval, somewhat elongate; elytra more strongly convex and inflated; pronotal sides less arcuate or somewhat as in the male.

In a series the form of the sexes varies from quite different to nearly similar, all gradations occur, however. The pronotal punctuation is *usually coarser toward the base* and finer toward the apex, and in the typical form there are large impunctate areas. A large series taken at Samoa, on Humboldt Bay, preserve the specific characteristics, but the punctures on the anterior part of the pronotum are coarser and stronger and subequal in size throughout the central area, as in a certain percentage of those taken about San Francisco. All gradations have been observed.

Casey has defined *curtulus*. The salient characters are: Very much more dilated than either *ciliatus* or *debilis*; epistoma much less tumid medially; pronotum shorter and more transverse, sides more strongly converging and arcuate from base to apex; anterior angles rather more deflexed and more rounded; surface less unequally punctate. Out of hundreds of specimens examined but four have been referred to this form. *Curtulus* is not distinct and has gradations in all directions.

Longulus is only an individual variation, or a group of individuals selected for certain characters which become evanescent in the aggregate.

Distribution.—Specimens have been examined from different places along the coast from Monterey County to Humboldt Bay.

A series of twenty-one specimens collected at Carmel, Monterey County, California, April 10th, 1919, and kindly contributed by Mr. L. S. Slevin, present several characters wherein they differ from typical *ciliatus* and from the forms described by Col. Casey. They represent a new variety which may be defined as follows:

***Coelus ciliatus* var. *sparsus* new variety**

Peculiar on account of the polished surface and shining luster, feeble elytral sculpturing and very sparsely punctate pronotum. Throughout the pronotal surface the punctures are about uniform in size, fine, as sparse at base as toward the apex and but slightly denser close to the lateral margin, otherwise as in typical *ciliatus*. The form is elliptical and rather elongate. Some males are a little broader and more distinctly oblong. The elliptical form is similar to a smaller number of specimens in the *debilis* series taken at Tomales Bay. In these latter the males are not only elliptical but may be oblong to oblong-oval, and the females may be either elliptical or oblong-oval as in typical *ciliatus*.

In *debilis* the surface luster is dull, the pronotal punctuation stronger but equally as sparse as in *sparsus*. In a series the sculpture becomes as feeble as in *pacificus*.

It must be remembered that no two individuals of a species are exactly alike. Therefore the specific units taken in the same locality and existing under the same environmental conditions present variations in body form, degree of sculpturing and color. Species inhabit certain geographical areas in which the environment differs in the localities within those areas; as a result some phase of body form, sculpturing or color predominates in each region. At the same time will be found other variational forms which are connected with the predominating form by all intermediate gradations. In another region of the area one of the latter variations will predominate.

When the individuals of any recognized specific aggregate from a geographical area are arranged according to some particular

character of body form, sculpturing or color, they constitute a grade to which the term form (*forma*) is applicable. The relationship of the individuals as regards each other and sex is what by common consent constitutes the grade of species.

So it is with the species of *Coelus* (*globosus*, *ciliatus* and *arenarius*). The recognition of forms is an aid in estimating individual variation and should be a check to considering them varieties or subspecies, which are grades of a higher order. These grades signify that a particular form is capable of reproducing more or less true to type of variation; in the first instance intermixed with the type form and in the second instance occupying a region separated from that inhabited by the type form. In both instances there are reversions to type form. These variations are physiological rather than morphological.

To consider intra-specific forms as defined above as varieties or subspecies is not logical or scientific, but on the contrary arbitrary and theoretical, depending on the view point and personal equation of the author.

Variations in body form, sculpturing and color occur among individuals that have developed from a batch of eggs laid by a single female. So then if brothers and sisters are separated and placed as different species, as is actually being done in the present day it is time to stop talking about scientific taxonomy. A great deal of this comes from ignorance of the true relationships in nature. Hence describing new species from uniques or very small series is more pardonable than when a large series of individuals is subdivided on trivial differences of body form, sculpturing or color. How would it do to treat the human species in the same way?

Personally the author has found it difficult to keep within the bounds of his own convictions, for often what is considered a form will be found to predominate in some region and to reproduce quite true to type, with a varying number of reversions to the type form. It is best to be conservative and to wait until facts are observed or verified in the field, rather than assumed in the laboratory, where theoretical assumption runs wild.

Coelus ciliatus variety ***debilis*** Casey

A long series has been taken from the sand dunes about San Francisco and to the southward, as well as at Dipsea and Tomales

Bay, Marin County, California. Specimens can be obtained throughout the year, although they are most abundant from March to July. The color varies from immaturity to nigropiceous.

Size small to medium. *Form* oblong-oval to somewhat elongate-oval. *Labrum* with two to five punctures in apical third, otherwise impunctate.

Epistoma arising abruptly from the frontal suture, its vertical base more or less transversely rugoso-punctate; surface of the median third very sparsely punctate, usually glabrous at middle anteriorly; lobes slightly prominent, feebly arcuate, sometimes subangulate; surface more or less impressed, rather densely and coarsely punctate, a few punctures coalescing; side margins oblique, feebly and broadly sinuate, oblique suture feeble; apical sinus broad and rather less than moderately deep.

Front not deeply impressed behind the suture, impression not distinctly defined from the general surface, not very densely punctate, most of the punctures furnished with a yellow hair.

Mentum comparatively small, sides straight and diverging as usual; apex feebly sinuate, angles narrowly rounded; surface not strongly punctato-scabrous, sometimes subcarinate in the median line.

Pronotum not strongly convex transversely; sides broadly rounded, or less so and more convergent; scarcely or narrowly explanate; disk rather finely, sparsely and more or less evenly punctate.

Prosternum not strongly asperato-punctate. Process glabrous and nearly impunctate on the median line and on central area of the dilated apex; peripheral punctures with long hairs; not distinctly margined between the coxae.

Male: Rather broad to elongate oblong-oval; pronotum broader, or similar to that of the female.

Female: Form variable as in the male; pronotum usually narrower; elytra slightly more inflated than in the male.

Measurements.—Length, 5–7 mm.; width, 2.8–4 mm.

A series taken from a single sand dune some distance from the shore of Tomales Bay, determines the general characteristics of this variety of *ciliatus*, as will be seen from the description the form is variable in the sexes with all intermediate gradations. About San Francisco (type region) the habitat is inland and often away from the dunes. The dryer environment may explain the smaller size. As compared with *ciliatus* it is usually much smaller in size and narrower, although some of the specimens are relatively as broad. In *debilis* the front is less strongly punctured behind the suture and the sculpturing generally is less developed. The elytra are frequently scarcely asperate, as in *pacificus*. The color is more brownish and in many specimens the suture is narrowly rufous and the surface luster dull and more or less subopaque. Some of the specimens are scarcely larger than *Coelomorpha maritima* Casey.

Coelus arenarius Casey

This species was described from specimens collected at San Pedro, Los Angeles County, California, and was founded on two examples. Specimens have been identified by the author from "Southern California" and Arch Rock, Los Angeles County.

Size varying, usually, between that of *debilis* and *saginitus*. *Form* more or less broadly oblong-oval and moderately convex.

Labrum with two to four punctules scattered on the apical third, otherwise smooth.

Epistoma arising abruptly at base from the frontal suture. Base on the vertical edge coarsely punctured and more or less transversely rugose; median area less coarsely and sparsely punctate; laterally the punctures are large, coalesce to a varying degree and are more or less dense; apex broadly and very feebly sinuate, the sinus more or less evenly rounded; lobes not at all prominent, broadly rounded to the arcuato-subsinuate sides of the *front*, the latter quite broadly and transversely impressed behind the suture, there more or less densely punctate, the punctures varying greatly in size and more or less coalescent, each with a yellow hair, these irregularly directed.

Mentum strongly sculptured, sides straight and divergent, apex feebly and broadly sinuate; angles moderately rounded; surface coarsely punctato-scabrous, more or less flatly impressed each side of a more or less distinct median carina.

Pronotum widest slightly before the base in the type form; sides quite strongly arcuate and convergent; disk broadly and not strongly convex transversely, sparsely and more or less regularly punctate; punctures rather dense at the sides where also they are more or less intermingled with coarser punctures; sides more or less declivo-explanate.

Prosternum not very coarsely punctate, these punctures not strongly impressed, subasperate. Process distinctly impunctate along the middle and on the central area of the dilated apex; punctures rather strong at the periphery, each with a long yellow hair; marginal bead rather strong and usually extending beyond the coxae.

Elytra about as wide as the pronotum; moderately inflated, more or less coarsely and asperately punctate, punctures more strongly granulose toward the apex.

Abdomen rather more than sparsely punctate, punctures rather strong and moderate in size.

Sexes less differentiated than in *globosus* and *ciliatus*. In the female the pronotum may be as wide as in the male, or less so and the form more elongate.

Measurements.—Length, 8.4 mm.; width, 5.1 mm. The two specimens that served as a basis for the original description measured 6.5 and 8.5 mm. in length.

Type locality.—San Pedro, California.

Coelus arenarius variety **sternalis** Casey

A small series recently collected at Santa Barbara by Mr. Van Duzee is referable to this variety. The distinguishing character

is the very coarsely punctured prosternum in front of the coxae. The punctures are more or less rounded, rather distinctly separated and impressed and there is a tendency to rugoseness. The surface is rather glossy in the series examined. The degree of constriction of the prosternal process is not staple and cannot be used in defining species in a genus like *Coelus*. Here is a parallel with *Coniontis* where the individuals of a specific aggregate vary greatly in form. *Arenarius* and *sternalis* are members of the *ciliatus* group, as evidenced by the epistomal base and mentum.

The sexes are of the usual form as in *arenarius*, the females are usually more or less narrower than the males.

Measurements.—Length, 6.5–8.6 mm.; width, 4.2–4.85 mm.

Type locality.—Santa Barbara, California.

***Coelus arenarius* variety *latus* Casey**

A definition of this variety must also include *amplicollis*. In a series they are inseparable.

Form stout, oblong to subquadrate. *Pronotum* closely, more or less coarsely punctate, punctures evenly distributed; sides distinctly declivo-explanate, but this character varies greatly in degree.

Prosternum coarsely and more or less confluent punctate, subrugose.

Male.—Broader and the sides of the pronotum are usually more strongly declivo-explanate.

Female.—Rather narrower, sides of the pronotum are less strongly declivo-explanate.

Measurements.—Length, 4.9–7.6 mm.; width, 3–5 mm.

It is often difficult to tell the sex by form alone. The name *amplicollis* has been given to the more common form, but on account of priority it must give way to *latus* Casey. The type locality for both is San Diego, California. *Amplicollis* is found abundantly with *globosus*, and *latus* Casey occurs as an extreme form of the former. A large series has been studied. These specimens were collected by the author in February and April, in 1890 and 1891, and by Mr. Van Duzee in August, 1916, at the type locality.

Casey in his third group of species founded on the degree of epistomal sinuation, divides those forms with a very feeble sinuation into two sections, based on the distribution of pronotal punctures, which, in a large series, is a very unstable and evanescent

difference. His next dichotomous division is on the form and relative width of the pronotum and elytral base. Both of these characters appear to be very arbitrary indeed. By an examination of a considerable series collected at Redondo it was observed that the individual specimens differed among themselves, as regards the relative width of the pronotum and elytral base, just as do the specimens taken at San Diego and referred to *amplicollis*, and all gradations exist between the two series. The same is true as regards *obscurus* and *scolopax*.

It is the writer's conviction founded on long and careful comparison of series collected along the southern California sea-coast that other characters must be found to differentiate *obscurus* and *scolopax*, or they must be considered as mere forms of *arenarius*. Theoretical grading of organisms based on geographical position is unacceptable when intrinsic structural or stable characters are wanting. Geographical position and environment act more physiologically than morphologically. Why not consider the muscular, sun-burnt and non-adipose farmer or country dweller as a different species from the fairer, non-muscular and adipose city dweller?

An analysis of the *arenarius* complex may be attempted by the following tabulation of published characters:

Epistoma broadly and very feebly sinuate, the sinus generally sub-evenly rounded.

Punctures of the pronotum unequally distributed, leaving large areas devoid of punctuation.

Body rather broadly oblong-oval. **arenarius**, San Pedro
Body more narrowly elongate-elliptical.

arenarius variety **sternalis**, Santa Barbara

Punctures of the pronotum almost evenly distributed.

Body evenly elliptical in form; prothorax not at all wider than the elytral base.

Form rather elongate. . **arenarius** form **obscurus**, Los Angeles County

Form relatively a little wider. . **arenarius** form **scolopax**, Redondo

Body broadly oblong-oval, prothorax more swollen basally, and at a short distance before the base, distinctly wider than the elytral base.

Body very stout and subquadrate.

arenarius variety **latus**, San Diego

Body similarly stout oblong, but little longer than wide.

arenarius form **amplicollis**, San Diego

The more detailed differences are:

- Head coarsely and densely punctate behind with a mixture of large and small punctures, sparse medially before the suture (*arenarius*); nearly as in *arenarius* but very coarsely, densely punctate behind the suture (*sternalis*). Entire basal region of head impunctate (*arenarius*); ? (*sternalis*).
- Epistoma moderately convex medially, flat laterally (*arenarius*); medially tumescent, rugosely but less densely punctate, flattened apical lobes more finely, closely and densely punctate (*sternalis*).
- Pronotum two and a half times as wide as long, sides strongly converging from base to apex and broadly arcuate, gradually more rounded basally, apical angles very evidently rounded (*arenarius*); less abbreviated, sides less strongly converging, broadly and subevenly arcuate from base to apex, apical angles more distinct and less rounded (*sternalis*).
- Pronotal surface sparsely and very strongly but not very coarsely punctured, punctures closer and laterally mingled with some that are much coarser (*arenarius*); surface similarly but sparsely punctate, the larger lateral punctures less coarse (*sternalis*).
- Pronotal sides not very widely declivo-explanate, bead strong (*arenarius*); sides more broadly declivo-explanate, bead similar (*sternalis*).
- Abdomen finely but strongly, sparsely punctate, more coarsely, densely so on last segment (*arenarius*); almost similarly punctate, last segment relatively less densely so (*sternalis*).
- Prosternal process only moderately constricted between the coxae (*arenarius*); process very strongly constricted, neck scarcely more than half as wide as the dilated and rounded posterior part (*sternalis*).
- Casey has said nothing about sexual differences.

The above tabulated and comparative notes give the salient synoptic and descriptive characters between the six forms of the *arenarius* section, and the relative differences between *arenarius* and *sternalis*, which are paralleled closely by *obscurus* and *scolopax*, *latus* and *amplicollis*.

Note that the differences are relatively slight, that the sexual differences are not considered, and that these insects are very variable, as has been and can be shown in any large series taken from a single sand dune anywhere between San Diego and Humboldt Bay.

The following characters are common to *arenarius* (*obscurus* and *scolopax*), *sternalis*, and *latus* (*amplicollis*):

Epistoma broadly and very feebly sinuate, the sinus generally subevenly rounded, base arising more or less abruptly from the frontal suture.

Front of the head more or less strongly, broadly and transversely impressed behind the suture.

Mentum punctato-scabrous, more or less carinate on the median line; sides straight and divergent; apex broadly and very feebly sinuate, apices of the subtriangular lobes rather narrowly rounded.

Prosternum before the coxae and process strongly, coarsely punctate, punctures more or less separated, rarely subrugose. Process more or less glabrous and impunctate along the median line and on the central area of the dilated apex.

Characters common to globosus (solidus) and grossus (saginitus):

Epistoma very deeply sinuate, base arising gradually and usually arcuately from the frontal suture; frontal plane beginning at suture, or, in other words, suture narrowly and deeply impressed, front feebly convex throughout.

Mentum relatively larger; surface more or less convex, glabrous centrally toward apex, there impunctate as a rule; deeply impressed laterally along the margin which is strongly beaded; sides less noticeably divergent and evidently arcuate; apex broadly and quite strongly sinuate; apices of the lobes rather broadly rounded, lobes sub-oblong.

Prosternum before the coxae and process coarsely punctato-rugose. Process strongly, coarsely, asperately punctate.

Characters common to ciliatus (longulus and curtulus), debilis and sparsus:

Epistoma more broadly and less deeply though conspicuously sinuate; sinus trapezoidal in form, the bottom narrowly transverse; base arising abruptly from the frontal suture.

Front of head flattened between suture, anterior margin of eyes and vertex, more channelled behind the suture.

Mentum relatively small; sides straight and divergent; apex broadly and feebly sinuate; apices of the lobes rather narrowly rounded; lobes subtriangular; surface asperato-punctate, rarely carinate on median line.

Prosternum in front of coxae and process asperato-punctate; process smooth and distinctly impunctate on median line and on the central area of the dilated apex.

Casey has given an interesting description of the larvae of *Coelus*.² It is very desirable to have the larvae studied from the view point of species.

Genitalia of Coelus

After prolonged and careful study of the genitalia in the series above considered no distinctive specific characters have been observed which would aid in the classification or diagnosis of the species.

Male genital characters: Edeagophore elongately flax-seed shaped, moderately depressed and reflexed at apex; color testaceous to dark castaneous according to maturity and degree of chitinization.

² Annals N. Y. Acad. Sci., v, p. 180.

Basale oblong in form, about two and a half times longer than wide; base rather strongly rounded; continuous with the *apicale* dorsally but showing an articular membrane laterally and ventrally, in the latter position the articular lines are oblique; sides inflexed, median area membranous beneath.

Apicale elongate; sides converging moderately; apex quite deeply cleft; bottom of cleft narrowly rounded, lobes punctate laterally, punctures setigerous, setae bristling, sides inflexed and not strongly chitinous, contiguous in basal half, separated apically by the edeagus, which is sublinguiform as in the *Eleodiini*.

Female genitalia: Genital segment quadrate. Valves divisable into dorsal, ventral and lateral plates. *Lateral plates* quite strongly chitinized, terminating posteriorly in a more strongly chitinized apex which is narrowly rounded at tip; dorso-laterally is a small fossa from which arises a pencil of rather long and slender setae; dorsal surface flattened and concave; body of plate with a number of moderately coarse setigerous punctures.

Dorsal plates much less chitinized; medial margin arcuate, not contiguous on median line; surface densely and quite coarsely punctate, punctures bearing rather soft and more or less reclining setae.

Ventral plates contiguous at base, medial margin arcuate; plates narrowed from base to apex, surface densely and quite coarsely punctate on about basal three-fifths; punctures all setigous, setae soft and more or less reclining. Dorsal plates reaching to about opposite the cercopodous fossae.

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PLATE XXXII

EXPLANATION OF FIGURES

Fig. 1.—Head of *Coelus globosus* Lec. See definition of group I.

Fig. 2.—Head of *Coelus ciliatus* Esch. See definition of group II.

Fig. 3.—Head of *Coelus arenarius* Casey. See definition of group II.

Fig. 4.—Edeagophore of *Coelus ciliatus* Esch.

A, ventral surface when *in situ*.

B, dorsal surface when *in situ*; the reverse of what it is in the *Eleodiini*.

Fig. 5.—Genital segments of female. *Coelus ciliatus* Esch.

C, dorsal view.

D, ventral view.

Fig. 6.—Mentum of *Coelus ciliatus* Esch. See definition of group II.

Fig. 7.—Mentum of *Coelus globosus* Lec. See definition of group I.

